I. Listing of Claims

1. (Currently Amended) A system for estimating body states of a vehicle comprising:

a first linear accelerometer and a second linear accelerometer mounted to the vehicle in separate locations from each other, the first and second linear accelerometers being configured to measure the acceleration of the vehicle in a first direction and generate measured first and second linear acceleration signals based on the acceleration of the vehicle in the first direction, the measured first and second linear acceleration signals defining a first set of linear acceleration signals;

a third linear accelerometer and a fourth linear accelerometer mounted to the vehicle in separate locations from each other, the third and fourth linear accelerometers being configured to measure the acceleration of the vehicle in a second direction and generate measured third and fourth linear acceleration signals based on the acceleration of the vehicle in the second direction, wherein the second direction is different from the first direction, the measured third and fourth linear acceleration signals defining a second set of linear acceleration signals;

a signal adjuster configured to transform the first and second sets of linear acceleration signals from a sensor coordinate system to a body coordinate system associated with the vehicle; and

an estimating filter configured to receive the transformed first and second sets of linear acceleration signals from the signal adjuster and process at least one of the transformed first and second sets of linear acceleration signals into at least one of a roll rate, a roll angle and a yaw rate<u>, based on at least one of the following equations:</u>

a) $A_{y,meas} = \ddot{y}_v + \dot{r}_v d_{xtoYA} + \ddot{\theta}_v d_{ztoRA} + r_v u$;

b) $A_{z,meas} = -g + \ddot{\theta}_v d_{ytoRA}$; and

c) $A_{x,meas} = -\dot{r}_v d_{ytoYA}$.

where:

$A_{x,meas}$ = acceleration in an x-direction;

$A_{y,meas}$ = acceleration in a y-direction;

$A_{z,meas}$ = acceleration in a z-direction;

$\ddot{y}_v$ = lateral acceleration of the vehicle;

$\dot{r}_v$ = angular acceleration about a yaw axis of the vehicle;

d_{xtoYA} = the distance along the x axis from one of the linear accelerometers to the yaw axis of the vehicle;

$\ddot{\theta}_v$ = angular acceleration about a roll axis of the vehicle;

d_{ztoRA} = the distance along the z axis from one of the linear accelerometers to the roll axis of the vehicle;

r_v = yaw rate of the vehicle;

u = longitudinal vehicle speed;

g = gravitational acceleration;

d_{ytoRA} = the distance along the y axis from one of the linear accelerometers to the roll axis of the vehicle; and

d_{ytoYA} = the distance along the y axis from one of the linear accelerometers to the yaw axis.

2. (Previously Presented) The system of claim 1 wherein the filter includes a model of the vehicle dynamics and a model of the linear accelerometers, the at least one of a roll rate, a roll angle and a yaw rate being based on the at least one of the transformed first and second sets of linear acceleration signals and the models of the vehicle dynamics and linear accelerometers.

3. (Previously Presented) The system of claim 2 wherein the filter includes an estimator, an algorithm being implemented in the estimator to process the at least one of the transformed first and second sets of linear acceleration signals and the models of the vehicle dynamics and linear accelerometers and generate the at least one of a roll rate, a roll angle and a yaw rate.

4. (Canceled)

5. (Previously Presented) The system of claim 1 further comprising an angular rate sensor.

6. (Canceled)

7. (Previously Presented) The system of claim 1 further comprising two linear accelerometers that measure accelerations in a third direction, wherein the third direction is different from the first and second directions.

8. (Canceled)

9. (Previously Presented) The system of claim 1 further comprising two linear accelerometers that measure the vertical accelerations of the vehicle.

10. (Canceled)

11. (Previously Presented) The system of claim 1 wherein the signal adjuster further provides compensation for gravity biases associated with the linear accelerometers.

12-17. (Canceled)

18. (Currently Amended) A system for estimating body states of a vehicle comprising:

a first linear accelerometer and a second linear accelerometer mounted to the vehicle in separate locations from each other, the first and second linear accelerometers being configured to measure the acceleration of the vehicle in a first direction and generate measured first and second linear acceleration signals based on the acceleration of the vehicle in the first direction, the measured first and second linear acceleration signals defining a first set of linear acceleration signals;

a third linear accelerometer and a fourth linear accelerometer mounted to the vehicle in separate locations from each other, the third and fourth linear accelerometers being configured to measure the acceleration of the vehicle in a second direction and generate measured third and fourth linear acceleration signals based on the acceleration of the vehicle in the second direction, wherein the second

direction is different from the first direction, the measured third and fourth linear acceleration signals defining a second set of linear acceleration signals; and

a filter configured to process the first and second sets of linear acceleration signals using a model to generate at least one of a roll angle, a roll rate, and a yaw rate, the model being a model of the vehicle dynamics and the linear accelerometers, the model being based in part on distances along at least one of an x-axis, a y-axis, and a z-axis from each of the linear accelerometers to at least one of a yaw axis and a roll axis of the vehicle,

the first linear accelerometer being located a first distance from the center of gravity of the vehicle, and the second linear accelerometer being located a second distance from the center of gravity of the vehicle, the first and second distances being unequal,

the third linear accelerometer being located a third distance from the center of gravity of the vehicle, and the fourth linear accelerometer being located a fourth distance from the center of gravity of the vehicle, the third and fourth distances being unequal.

19. (Previously Presented) The system of claim 18, the filter further comprising an estimator configured to implement an algorithm having a feedback loop to process the first and second sets of linear acceleration signals using the model, the estimator being further configured to output the at least one of a roll angle, a roll rate, and a yaw rate.

20. (Previously Presented) The system of claim 18, further comprising a signal adjuster configured to transform the first and second sets of linear

acceleration signals from a sensor coordinate system to a body coordinate system associated with the vehicle.

21. (Previously Presented) The system of claim 18 further comprising two linear accelerometers that measure accelerations in a third direction, wherein the third direction is different from the first and second directions.

22. (Previously Presented) The system of claim 18 further comprising two linear accelerometers that measure vertical accelerations of the vehicle.

23. (Previously Presented) The system of claim 20 wherein the signal adjuster provides compensation for gravity biases associated with the linear accelerometers.

24. (Previously Presented) The system of claim 18 further comprising an angular rate sensor.

25-30. (Canceled)

31. (New) The system of claim 1, wherein the first and second linear accelerometers are located at unequal distances from the center of gravity of the vehicle, and the third and fourth linear accelerometers are located at unequal distances from the center of gravity of the vehicle.

32. (New) The system of claim 18, wherein the model is based on at least one of the following equations:

a) $A_{y,meas} = \ddot{y}_v + \dot{r}_v d_{xtoYA} + \ddot{\theta}_v d_{ztoRA} + r_v u$;

b) $A_{z,meas} = -g + \ddot{\theta}_v d_{ytoRA}$; and

c) $A_{x,meas} = -\dot{r}_v d_{ytoYA}$,

where:

$A_{x,meas}$ = acceleration in an x-direction;

$A_{y,meas}$ = acceleration in a y-direction;

$A_{z,meas}$ = acceleration in a z-direction;

$\ddot{y}_v$ = lateral acceleration of the vehicle;

$\dot{r}_v$ = angular acceleration about a yaw axis of the vehicle;

d_{xtoYA} = the distance along the x axis from one of the linear accelerometers to the yaw axis of the vehicle;

$\ddot{\theta}_v$ = angular acceleration about a roll axis of the vehicle;

d_{ztoRA} = the distance along the z axis from one of the linear accelerometers to the roll axis of the vehicle;

r_v = yaw rate of the vehicle;

u = longitudinal vehicle speed;

g = gravitational acceleration;

d_{ytoRA} = the distance along the y axis from one of the linear accelerometers to the roll axis of the vehicle; and

d_{ytoYA} = the distance along the y axis from one of the linear accelerometers to the yaw axis.